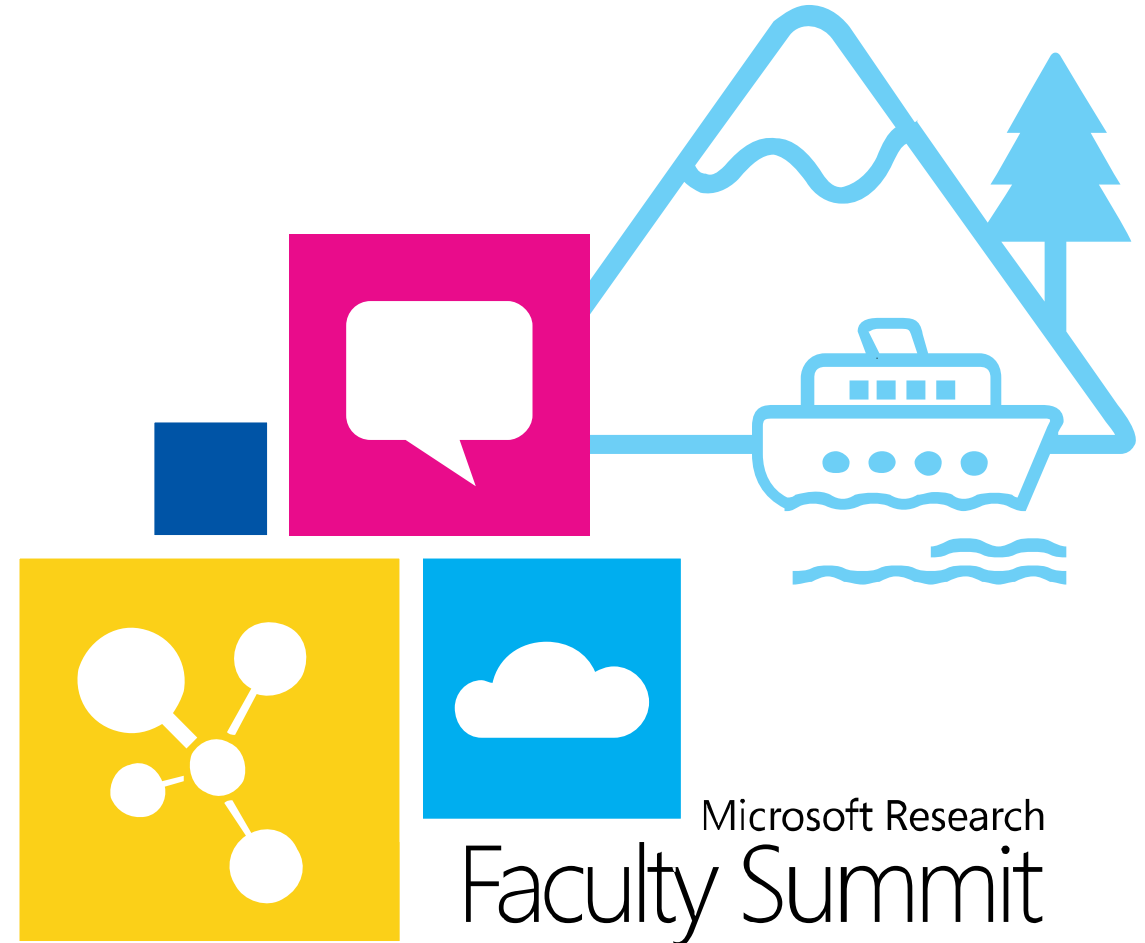




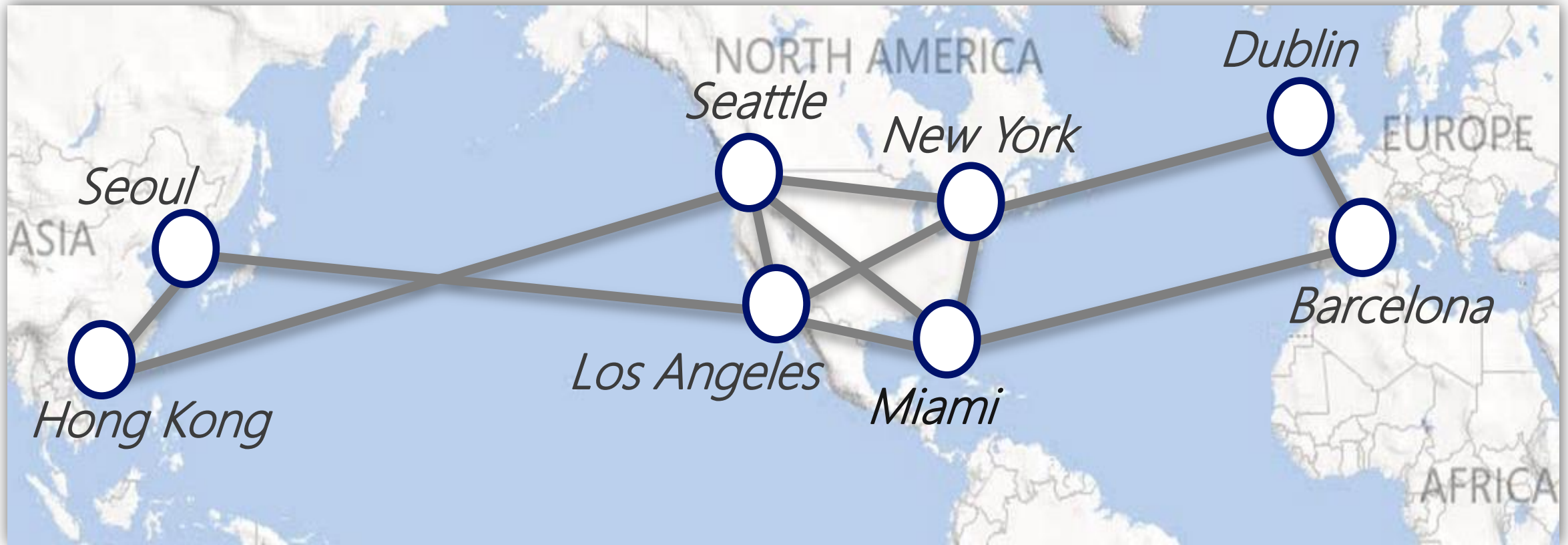
Software-driven wide area network

Ratul Mahajan
Microsoft Research

with Vijay Gill, Chi-Yao Hong, Srikanth
Kandula, Dave Maltz,
Mohan Nanduri, Roger Wattenhofer,
Lihua Yuan, Ming Zhang



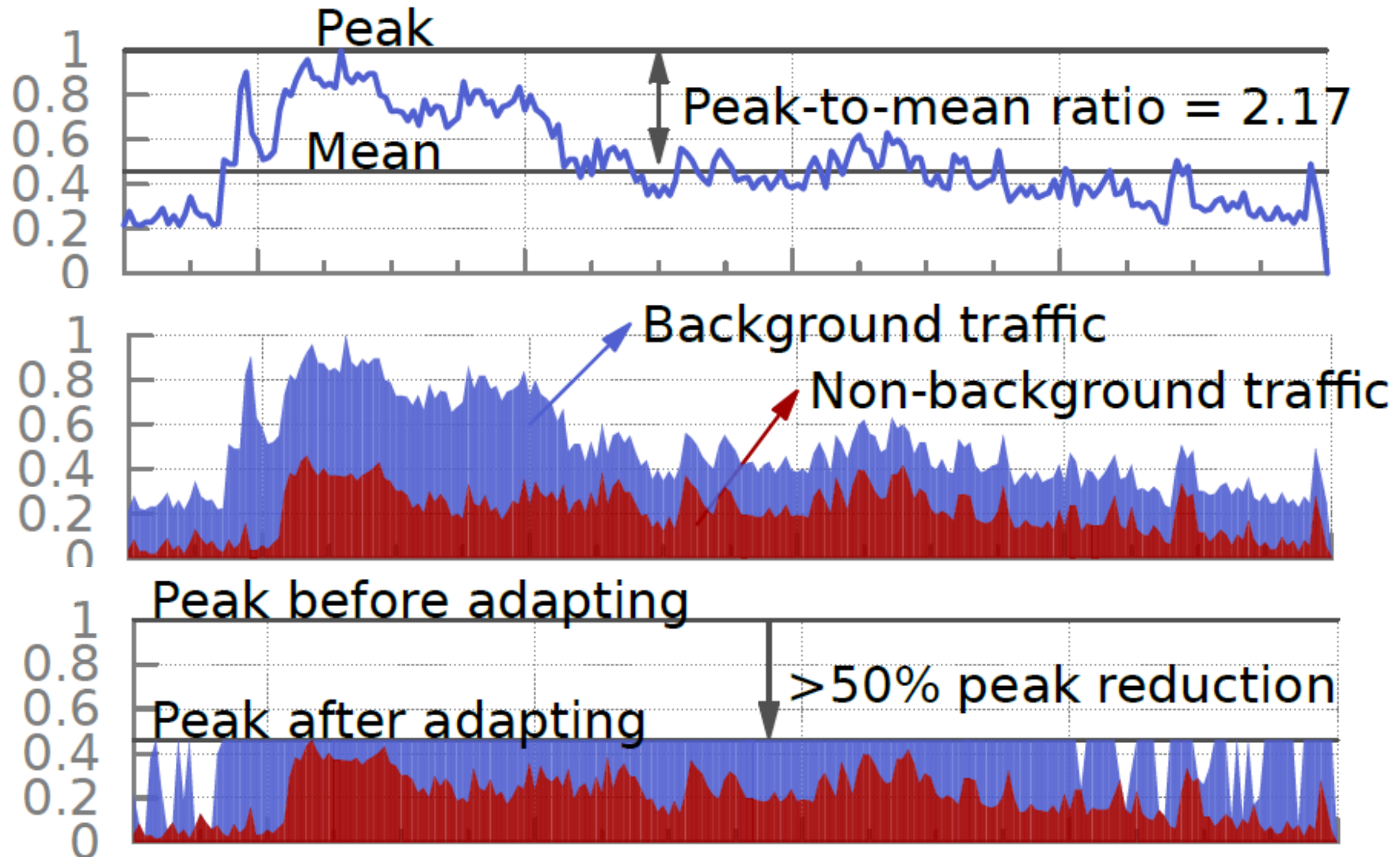
Inter-DC WAN: A critical, expensive resource



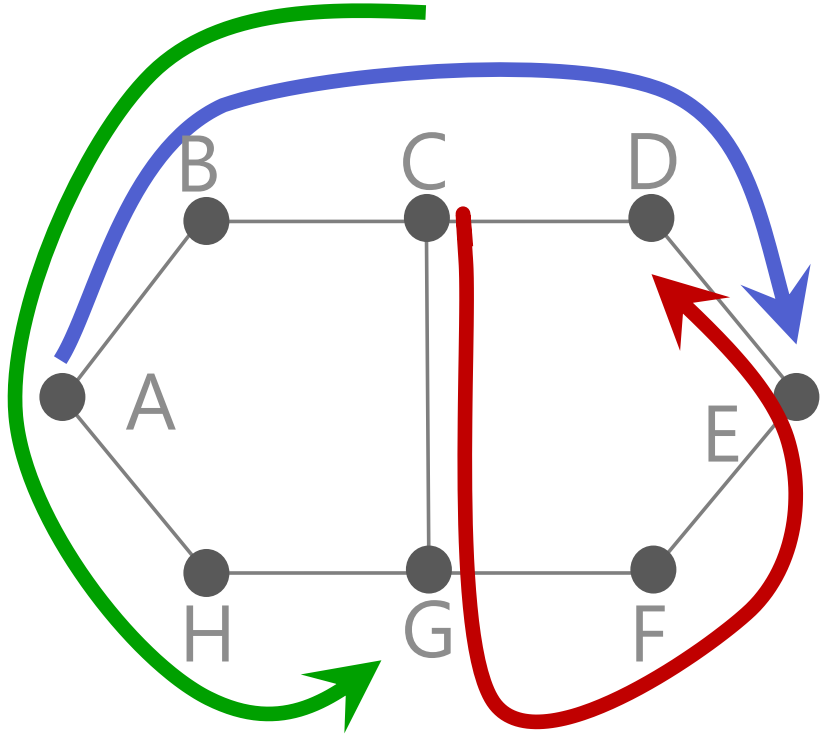
But it is highly inefficient



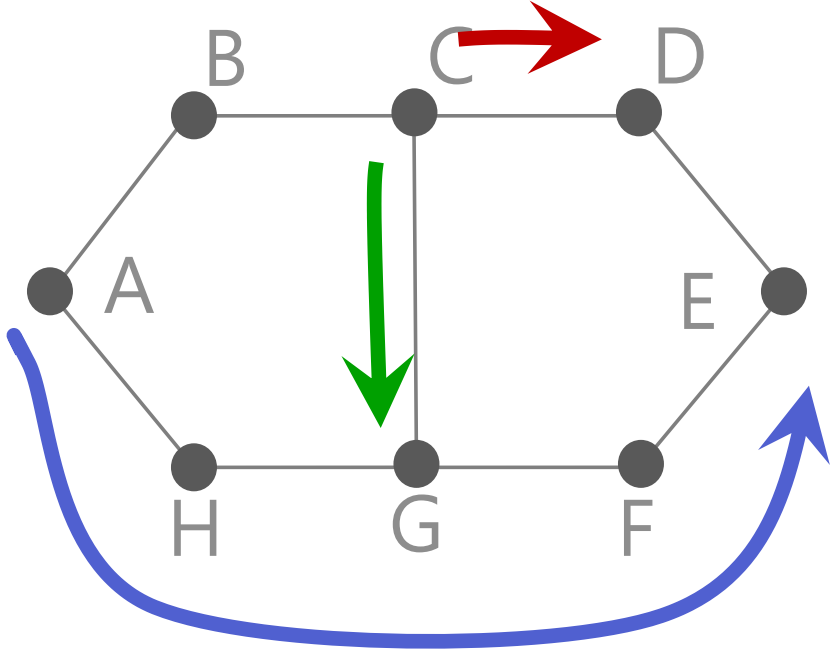
One cause of inefficiency: Lack of coordination



Another cause of inefficiency: Local, greedy resource allocation



Local, greedy allocation



Globally optimal allocation



SWAN: Software-drive WAN

Goals:

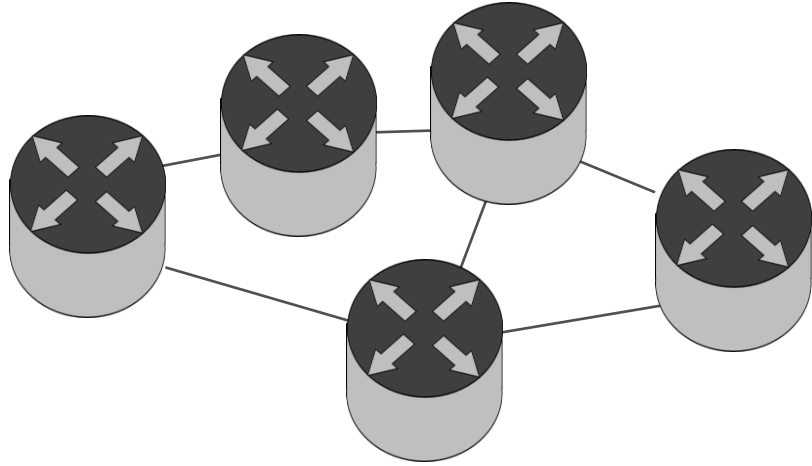
- Highly efficient WAN
- Support flexible sharing policies
 - Strict priority classes
 - Max-min fairness within a class

Key design elements:

- Coordinate the sending rate of services
- Centralized resource allocation

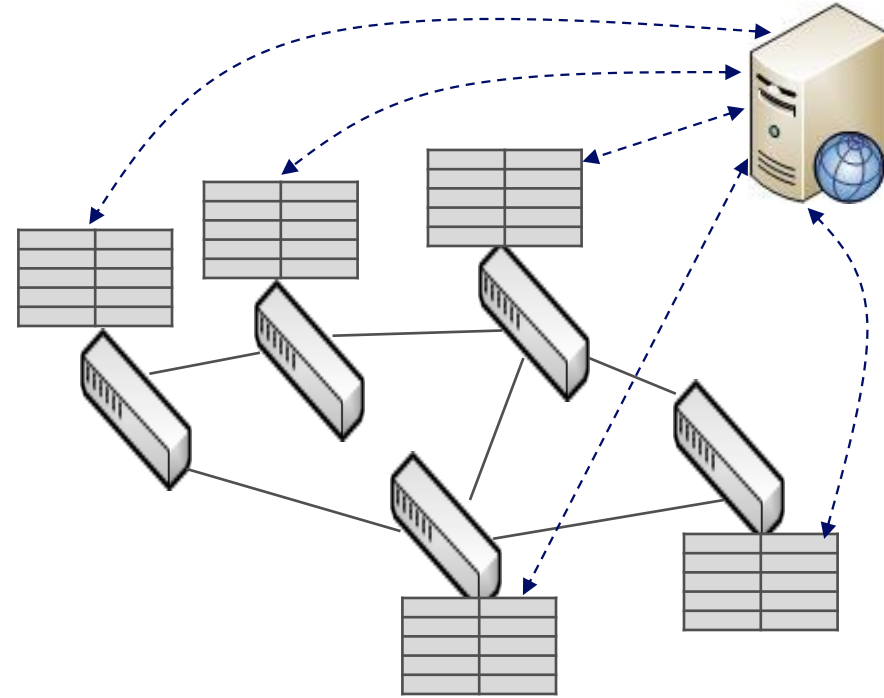


SDN primer



Networks today

- Beefy routers
- Control plane: distributed, on-board
- Data plane: indirect configuration

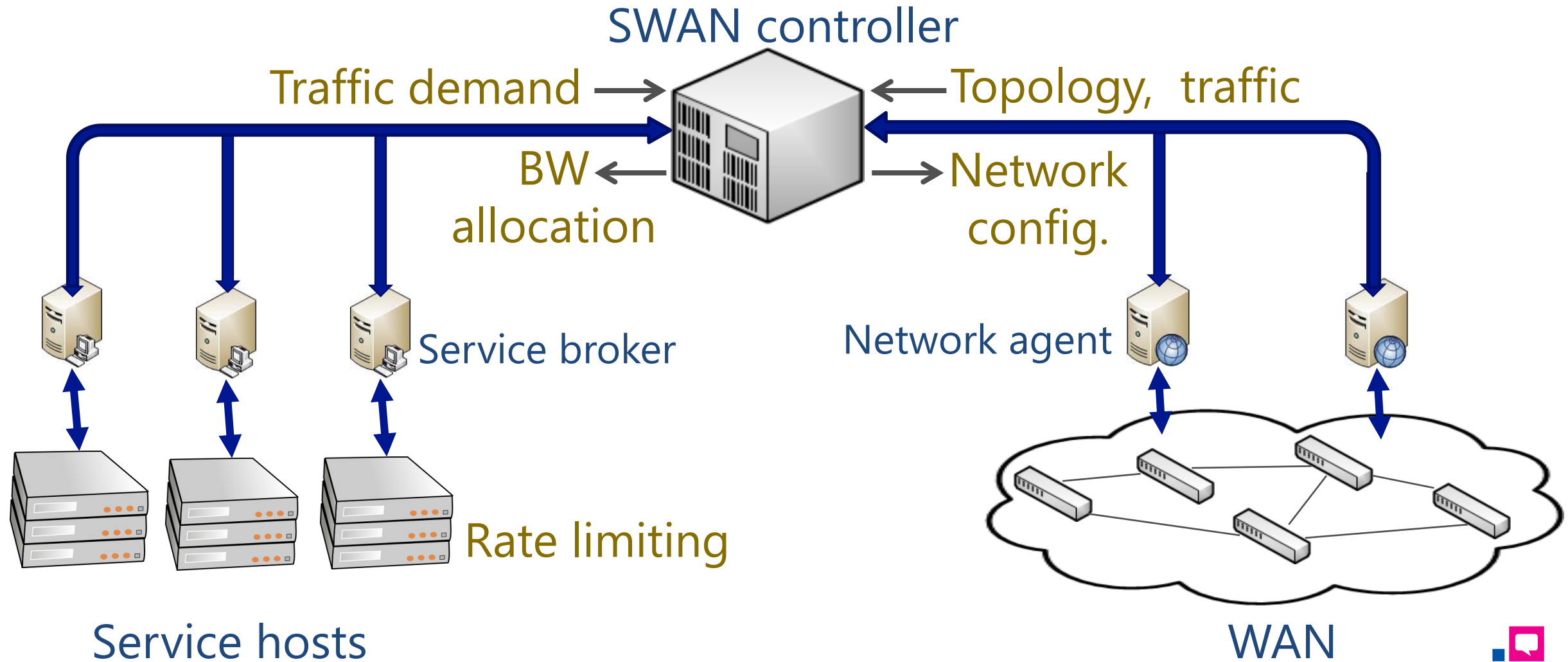


SDNs

- Streamlined switches
- Control plane: centralized, off-board
- Data plane: direct configuration



SWAN overview



Key design challenges

Scalably computing
BW allocations and
network config

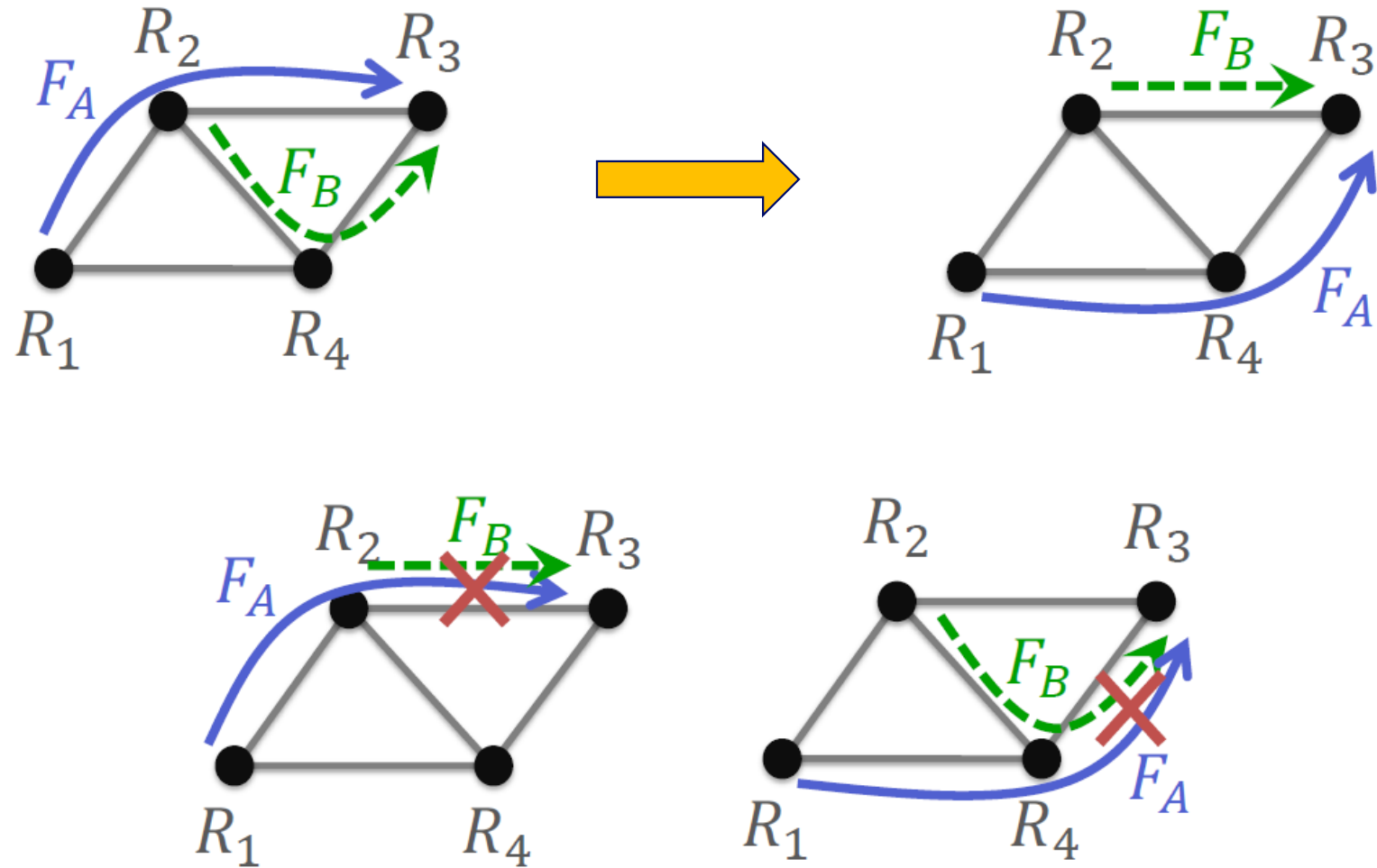
Avoiding
congestion during
network updates

Working with
limited switch
memory

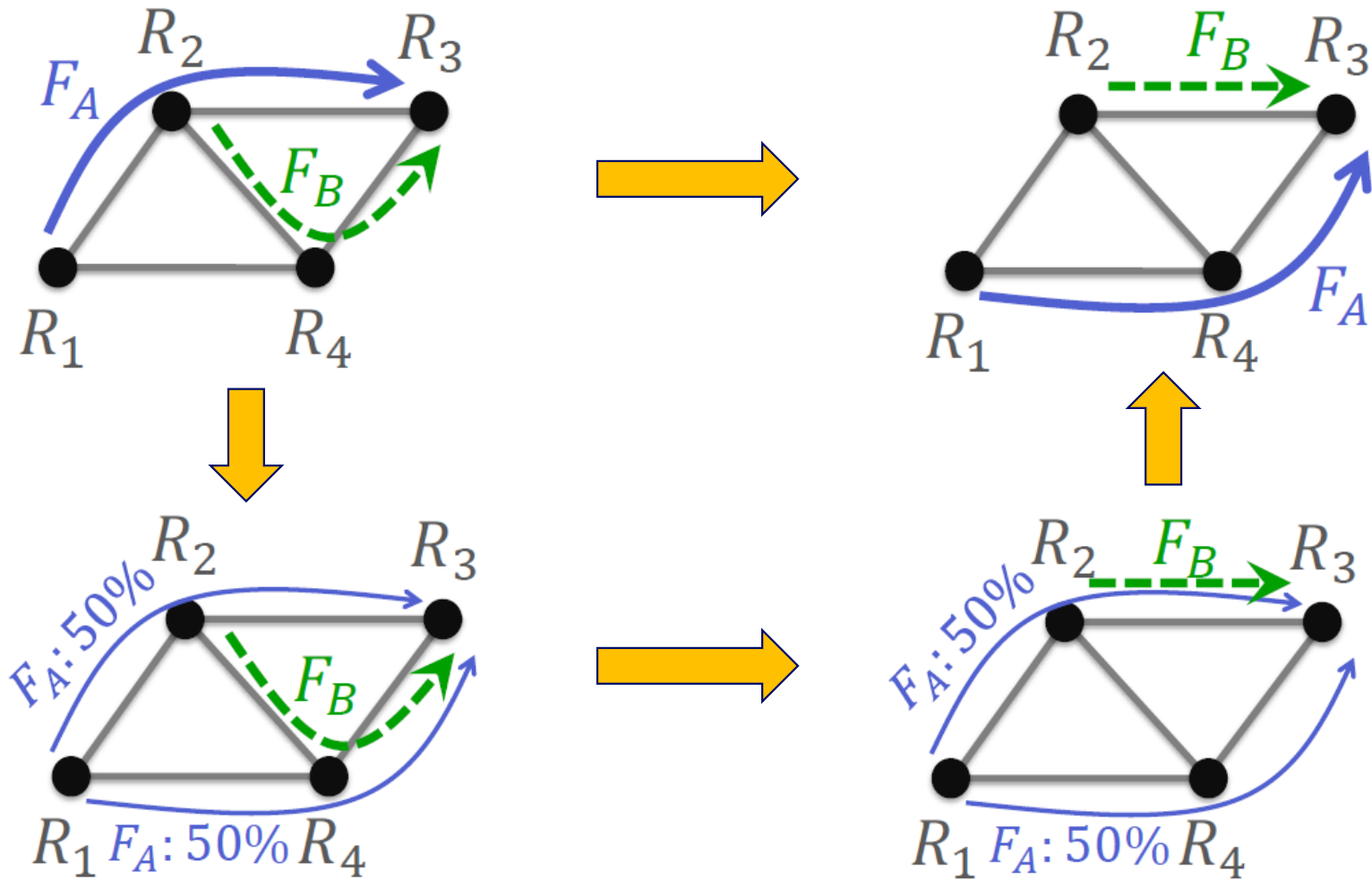
Resilience to failures
and bugs



Congestion during network updates



Congestion-free network updates



Computing congestion-free update plans

Leave scratch capacity s on each link

- Ensures a plan with at most $\left\lceil \frac{1}{s} \right\rceil - 1$ steps

Find a plan with minimal number of steps using an LP

- Search for a feasible plan with 1, 2, max steps

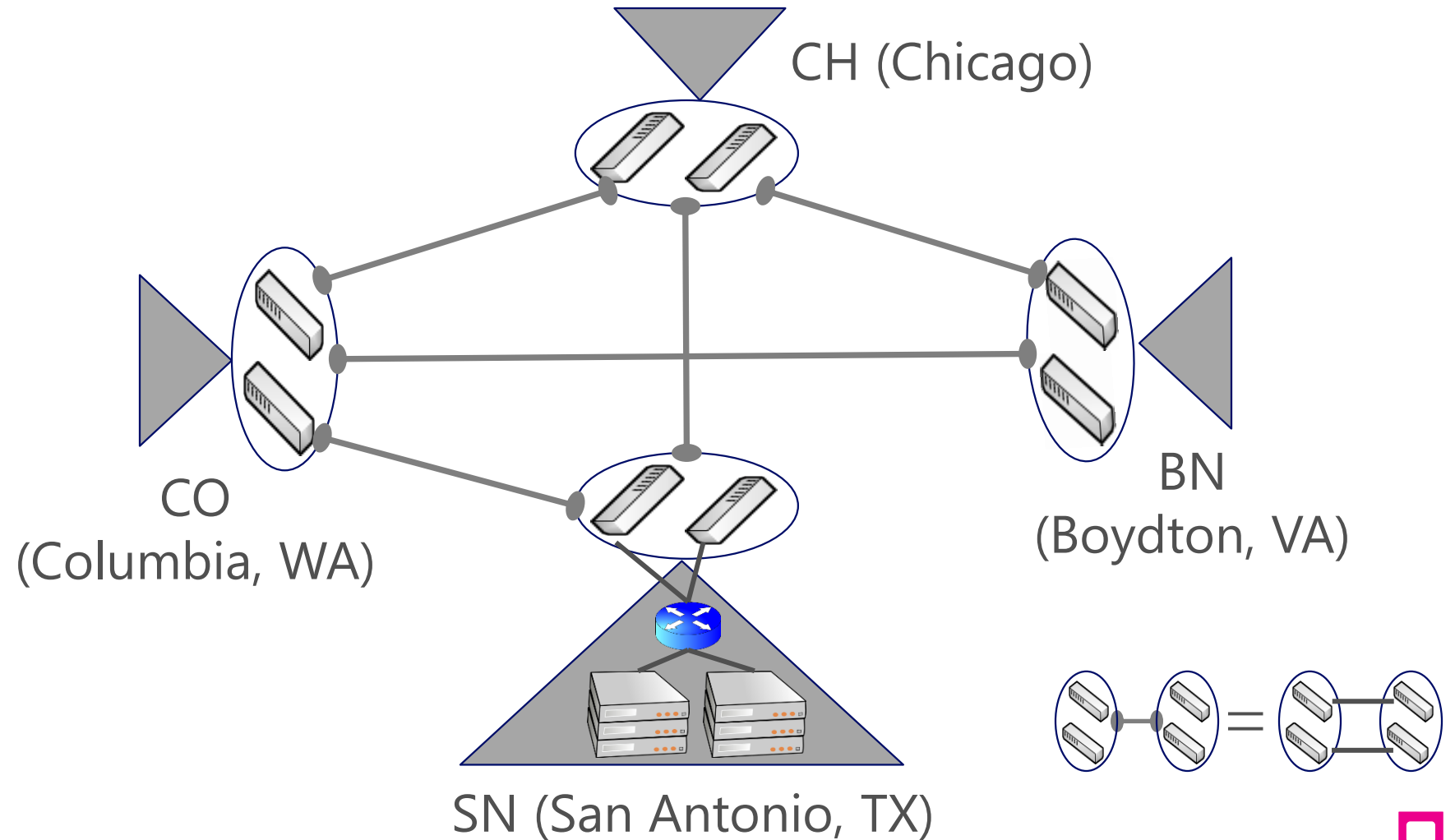
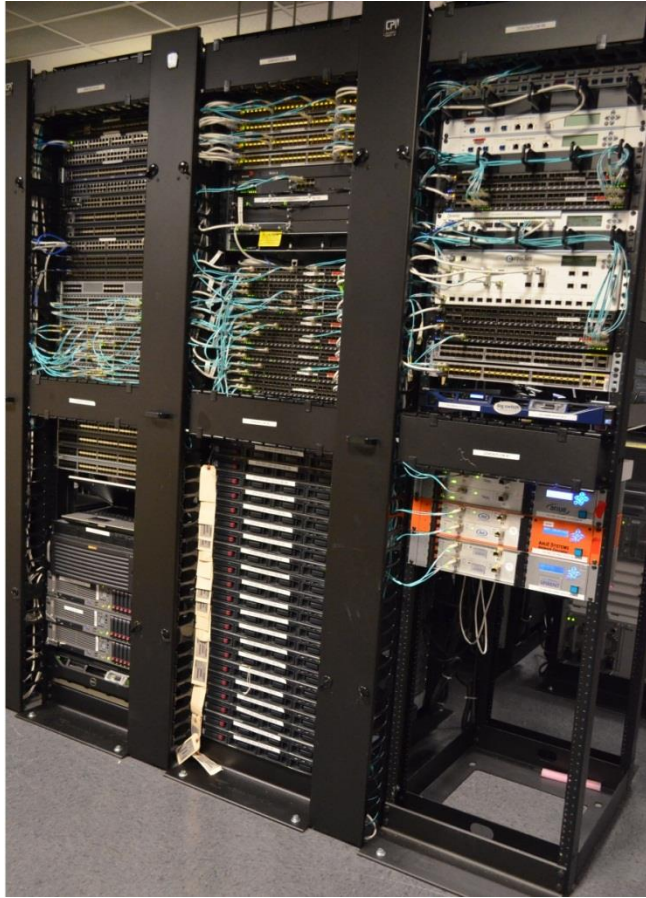
Use scratch capacity for background traffic



Demo

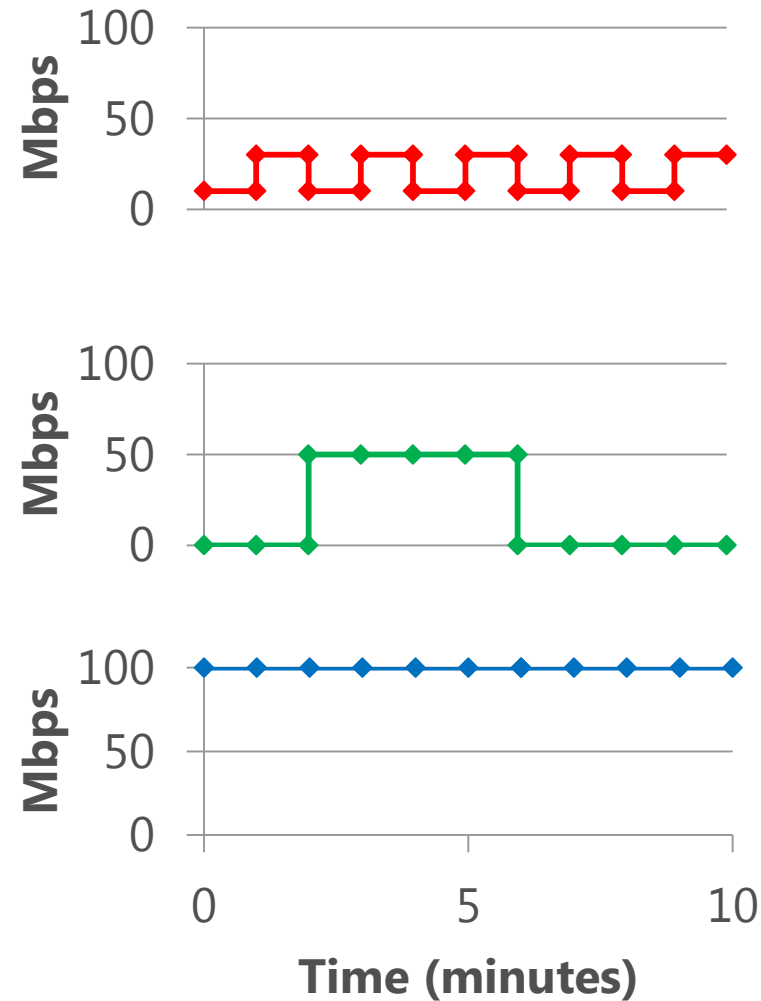


Demo topology



Demo traffic

Interactive
(High priority)

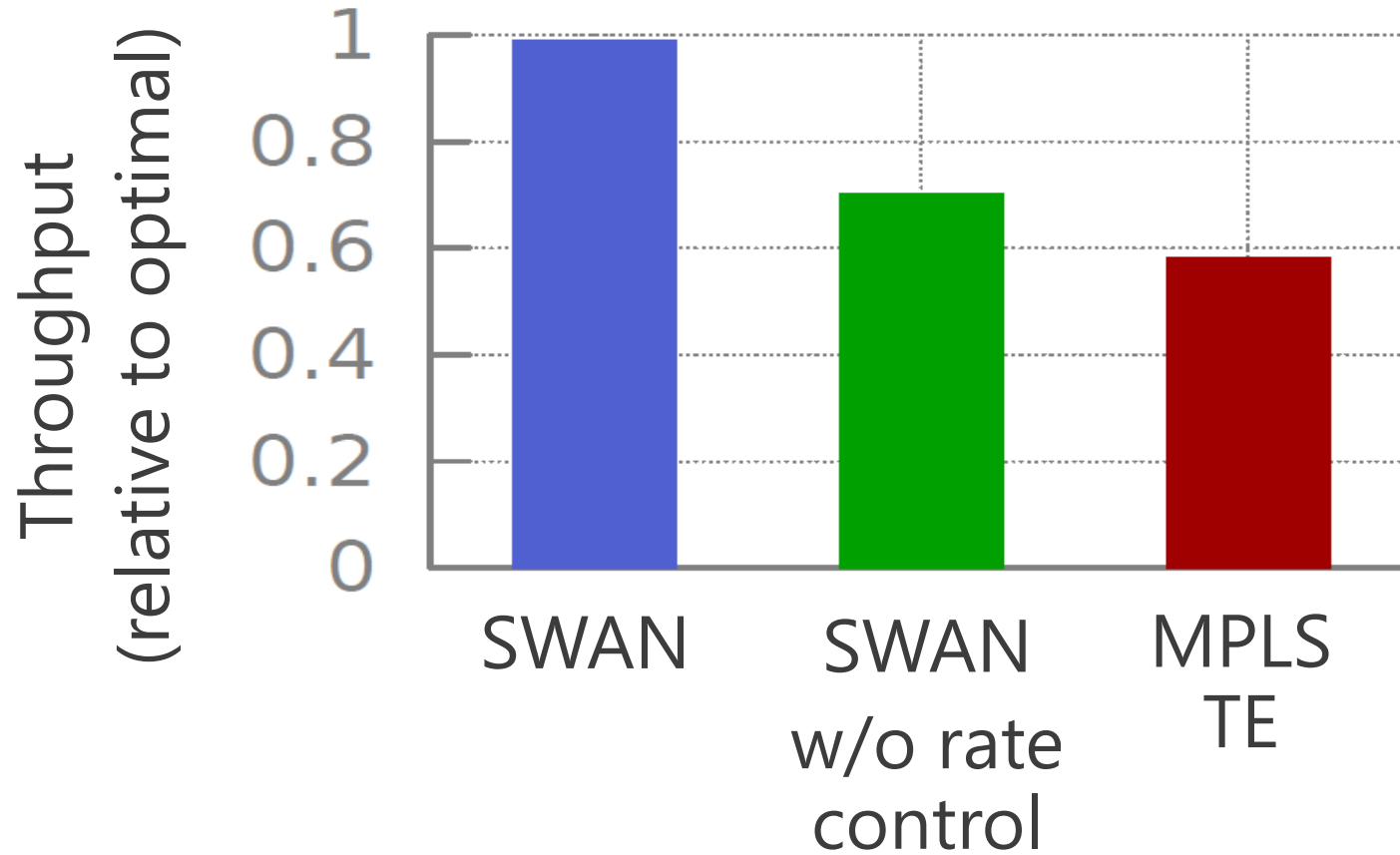


Elastic
(Mid priority)

Background
(Low priority)



SWAN comes close to optimal



Summary

SWAN yields a highly efficient and flexible WAN

- Coordinates transmissions of services
- Allocates resources centrally
- Manages transitions between allocations

High efficiency is key to cost-effective cloud services

- Many avenues for impactful research
- Opportunity to be “clean slate”

